National Transport Model for the Republic of Croatia

CLOSING CEREMONY – 04 MAY 2016

Investing in Future European Union

The project is co-financed by European Union from the European Regional Development Fund
AGENDA
1. Introduction
2. The Tasks and Approach
3. The Results
4. The Way Forward
AGENDA

1. Introduction
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3. The Results
4. The Way Forward
PURPOSE AND SCOPE OF THE PROJECT

Why do we need a National Transport Model for the Republic of Croatia?

Development of National Transport Strategy
- Identification of shortcomings / bottlenecks / needs for improvement
- Development of strategy alternatives
- Development of policies, investment strategies, projects and measures
- Assess the impacts of the different alternatives and select the most promising option
  - Impacts on transport itself: other road users, public transport users, pedestrians
  - Impacts on access and accessibility
  - Impacts on economic development
  - Impacts on the environment (natural, man-made, social)
  - Impacts on communities, visual intrusion
  - Impacts on participation, gender aspects
  - Impacts on quality of life
  - …
THE PROJECT TEAM: STRENGTHS

- Strong resources and backstopping capacity
- Local knowledge and experience
- International experiences
- Specific modelling expertise
- PTV Group: the mind of movement
- DRI: upravljanje investicij
- pnz
- inecoo
# PROJECT TIME SCHEDULE

<table>
<thead>
<tr>
<th>Task</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>May</td>
<td>Jun</td>
<td>Jul</td>
</tr>
<tr>
<td>Inception Phase</td>
<td></td>
<td></td>
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<tr>
<td>Implementation Phase</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Data Collection and Surveys</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Model Implementation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Visibility Events</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Duration</td>
<td></td>
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</tr>
</tbody>
</table>

Planned regular project duration

Reserve
AGENDA

1. Introduction

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THE TASKS AND THE APPROACH: DEVELOPING A NATIONAL TRANSPORT MODEL FOR CROATIA

I. Collection of Data
II. Analysis of existing transport system
III. Development of Freight Demand Model
IV. Development of Passenger Demand Model
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VI. Assignment: Calibration and Validation of the Model
VII. Development of Forecast Model 2020, 2030 and 2040 (Do Minimum)
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## COLLECTION OF EXISTING DATA

<table>
<thead>
<tr>
<th>Group of data</th>
<th>Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative units</td>
<td>State Geodetic Administration</td>
</tr>
<tr>
<td>Socioeconomic data</td>
<td>Croatian Bureau of Statistics; Ministry of Science, Education and Sports; Croatian Chamber of Economy; Financial Agency, Ministry of Tourism, Tourist Boards (20 Counties and City of Zagreb), Ministry of Interior</td>
</tr>
<tr>
<td>Road transport</td>
<td>Croatian Roads Ltd., Croatian Motorways Maintenance and Tolling Ltd., Motorway Zagreb – Macelj Ltd., BINA Istra Ltd.</td>
</tr>
<tr>
<td>Public transport</td>
<td>Ministry of Maritime Affairs, Transport and Infrastructure, InfoDom Ltd., Croatian Chamber of Economy</td>
</tr>
<tr>
<td>Urban Public transport</td>
<td>Zagreb holding Ltd. Branch ZET, Zagreb, Promet Ltd., Split, GPP Ltd., Osijek, KD Autotrolej Ltd., Rijeka</td>
</tr>
<tr>
<td>Railway transport</td>
<td>HŽ Infrastructure Ltd., HŽ Passenger transport Ltd., HŽ Cargo Ltd.</td>
</tr>
<tr>
<td>Airports transport</td>
<td>Zagreb International Airport, Zadar Airport, Split Airport Ltd., Rijeka Airport, Airport Pula, Osijek Airport Ltd., Dubrovnik Airport, Varaždin Airport Ltd.</td>
</tr>
<tr>
<td>Maritime transport</td>
<td>Agency for Coastal Shipping, Port Rijeka, Port Zadar, Port Šibenik, Port Split, Port Ploče</td>
</tr>
<tr>
<td>Inland Waterways</td>
<td>Agency for Inland Waterways, Port authority Vukovar, Port authority Osijek, Port authority Slavonski brod, Port authority Sisak</td>
</tr>
</tbody>
</table>
COLLECTION OF DATA
THE SURVEYS

Household Survey on passenger traveller behaviour (sample: 3,000 households)
- Target population: persons aged 14 and older
- Results seem reasonable
- Data analyses and coding of results in database finalised

Survey on drivers of mode choice in freight planning
- 37 interviews from sample of 414 companies
- 220 shipments described with detailed characteristics

Passenger counting on public transport services
- Fieldwork: 20.04.2015 – 20.05.2015
- In total, 6,487 arrivals/departures and 108,813 passenger were counted at 78 selected locations
SURVEY RESULTS – MOBILITY RATES

- RoC: 2.45, 3.23
- Continental Croatia: 2.26, 3.06
- Adriatic Croatia: 2.85, 3.57

Legend:
- Blue: all
- Red: mobile persons
SURVEY RESULTS – MOBILITY RATES

Trip rates / time spent travelling by age groups

- 14-29: 3.03 trips, 53 time spent
- 30-39: 2.96 trips, 47 time spent
- 40-49: 2.56 trips, 48 time spent
- 50-64: 2.36 trips, 39 time spent
- 65+: 1.47 trips, 23 time spent

Trip rates / time spent travelling by highest education level

- Primary education or less: 2.08 trips, 34 time spent
- Secondary education: 2.48 trips, 42 time spent
- Higher education: 3.04 trips, 55 time spent

Trip rates / time spent travelling by gender

- Men: 2.56 trips, 46 time spent
- Women: 2.35 trips, 37 time spent

Non-mobile People

- Retired: 55.1%
- Looking after family/home: 7.2%
- Pupil/student: 3.8%
- Employed: 57.7%
- Other: 4.6%
- Unemployed: 23.6%
SURVEY RESULTS – MODAL SHAREs

Proportion of all trips by the type of purpose

- **go home**: Continental Croatia 43.1%, Adriatic Croatia 42.1%
- **shopping**: Continental Croatia 14.8%, Adriatic Croatia 14.2%
- **leisure**: Continental Croatia 12.6%, Adriatic Croatia 15.4%
- **other**: Continental Croatia 12.4%, Adriatic Croatia 13.0%
- **go to work**: Continental Croatia 12.3%, Adriatic Croatia 11.7%
- **go to school**: Continental Croatia 4.7%, Adriatic Croatia 3.5%

Proportion of all trips by mode of transport

- **car**: Continental Croatia 49.4%, Adriatic Croatia 54.1%
- **public transport**: Continental Croatia 15.1%
- **bicycle**: Continental Croatia 7.1%
- **walking**: Continental Croatia 27.2%
- **other**: Continental Croatia 1.3%
THE TASKS AND THE APPROACH: DEVELOPING A NATIONAL TRANSPORT MODEL FOR CROATIA

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VIII. Development of Forecast Scenario for Strategy (Do Something)
TRAFFIC COUNTS

Objective
- Analysing the traffic flows in Croatia

Data available
- 500 Count Locations
  - AADT: Average Annual Daily Traffic
  - ASDT: Average Summer Daily Traffic
  - Categories of vehicles according to specific groups or vehicle lengths
- 300 count locations with Hourly data
  - Verification / plausibility checks with results from the above 500 count locations
  - Identification of hourly patterns of traffic flows
  - Identification of typical Peak Hours
TRAFFIC COUNTS

Traffic counts on the Croatian road network
TRAFFIC COUNTS

AADT
Total of vehicles
TRAFFIC COUNTS

ASDT
Total of vehicles
TRAFFIC COUNTS

AADT
Proportion of heavy vehicles

AADT: Proportion of heavy vehicles
- 0% - 5%
- 5% - 10%
- 10% - 15%
- 15% - 25%
- 25% - 35%
- 35% - 60%
TRAFFIC COUNTS

ASDT
Proportion of heavy vehicles
TRAFFIC COUNTS

Peak hour

Weekday

Off-season

• Average peak hour: 16:00-17:00

• Significantly earlier in the Split-Dalmatia County

• Later (at 17:00-18:00) in the Zagreb area

• PHF: 7.9 % of daily traffic
TRAFFIC COUNTS

Peak hour
Weekend
On-season

- Average peak hour: 11:00-12:00
- Similarities with off-season distribution in the Slavonian region
- Greater traffic dispersion throughout the day
- PHF: 7.2% of daily traffic
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FREIGHT MODEL DEVELOPMENT

Demand calculation

- Integrated multi-modal freight model in VISUM
- Combination of multi-modal Commodity Model and Round Trip Model

Commodity Model

<table>
<thead>
<tr>
<th>Calculation Steps</th>
<th>Calculation Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Generation</td>
<td>Volumes per Traffic Zone [t/a]</td>
</tr>
<tr>
<td>Freight Distribution</td>
<td>Flows between Traffic Zones [t/a]</td>
</tr>
<tr>
<td>Mode Choice*</td>
<td>Flows between Traffic Zones by Mode [t/a]</td>
</tr>
<tr>
<td>Conversion to Vehicle Trips</td>
<td>Trips between Traffic Zones by Mode (incl. Unloaded Drives)</td>
</tr>
<tr>
<td>Assignment</td>
<td>Trips per Link (incl. Unloaded Drives)</td>
</tr>
</tbody>
</table>

Round Trip Model

Differentiation of:

S ... Start trip (Trip 1)
E ... End trip (Trip RK)
C ... Connection Trip
     (Consignee i - Consignee i+1)
FREIGHT MODEL DEVELOPMENT

Initial calculation results

Production / attraction volumes for each commodity
FREIGHT MODEL DEVELOPMENT

Initial calculation results

Ton flow matrices for each commodity
FREIGHT MODEL DEVELOPMENT

Initial calculation results

Modal ton flows
FREIGHT MODEL DEVELOPMENT

Initial calculation results

Converted vehicle matrices from modal ton flow matrices
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PASSENGER DEMAND (CHARACTERISTICS)

**MODES**
- car (road, parking)
- public transport (bus, rail, sea)
- maritime (ferry)
- Park&Ride
- air
- bike and walk

**SUBMODELS**
- external trips (Europe)
- business trips (Croatia)
- airport access (Croatia)
- car ownership model (Croatia)
- gas emmision model (HBEFA)

**TIME PERIODS**
- average workday
- peak hour on workday
- average weekend day in season
- average peak hour on weekend in season

**TRIP PURPOSE**
(13 ORIGIN DESTINATION GROUPS):
- work
- education (offseason)
- shopping
- leisure
- other
- tourism (in season)
PASSENGER DEMAND (METHODOLOGY)

**Trip Generation**
Origin production_{purpose} = observed mobility rate_{purpose} * number of reference persons (population, employees, students…)

**Trip Distribution and Mode Choice**
Distribution_{purpose} and mode choice_{mode} = F (generalized impedance, observed trip distribution, observed modal split)

**Trip Generation:**
Destination attraction_{purpose} = attraction rate * number of reference socioeconomic data (workplaces, schoolplaces…)

**Assignment**
= F (generalized cost, path search, capacity restraint…)

---

[Diagram and data visualizations related to trip generation and distribution]
# PASSENGER DEMAND (DATA SOURCES)

<table>
<thead>
<tr>
<th>step</th>
<th>sub-step</th>
<th>element</th>
<th>source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trip Generation</strong></td>
<td>production</td>
<td>mobility</td>
<td>household survey</td>
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<tr>
<td></td>
<td>attraction</td>
<td>socioeconomic data</td>
<td>population (Bureau of Statistics), workplaces by sectors (business register), schoolplaces (school register), tourism (overnight stays)</td>
</tr>
<tr>
<td><strong>Trip distribution and mode choice</strong></td>
<td>impedance calculation</td>
<td>skim matrices</td>
<td>transport model</td>
</tr>
<tr>
<td></td>
<td>trip distribution</td>
<td>duration, length</td>
<td>household survey</td>
</tr>
<tr>
<td></td>
<td>modal split</td>
<td></td>
<td>household survey</td>
</tr>
<tr>
<td><strong>Assignment</strong></td>
<td>private transport</td>
<td>access/egress time, journey time, distance and money costs</td>
<td>transport model</td>
</tr>
<tr>
<td></td>
<td>public transport</td>
<td>access/egress time, journey time, fare, frequency</td>
<td>transport model</td>
</tr>
</tbody>
</table>
PASSENGER DEMAND (SOCIOECONOMIC DATA)

Working places

- <= 250
- <= 750
- <= 1250
- <= 2500
- <= 5000
- <= 7500
- <= 10000
- > 10000
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NETWORK MODEL

Internal (985) and external (267) traffic zones
SEPARATION OF THE TERRITORY INTO TRAFFIC ZONES

Total no. of Zones 985
- towns/municipalities 526
- settlements 146
- statistical circles 313
NETWORK MODEL

Internal and external road network (approx. 360,000 km)
NATIONAL ROAD NETWORK

- **Network** 34,685 km
  - National Roads 26,445 km
    - motorways 1,170 km
    - trunk roads 175 km
    - primary roads 6,850 km
    - secondary roads 9,530 km
    - tertiary roads 8,230 km
    - unclassified roads 490 km
  - Urban Roads 3,050 km
    - avenues 100 km
    - main street 1,320 km
    - street 1,330 km
    - residential 300 km
  - Rail 2,565 km
    - international main 785 km
    - international other 650 km
    - regional 620 km
    - local 510 km
  - Ferry/Boat 2,625 km
Public Transport Network

- stops (only Croatia) 5,867
- lines 4,941
  - national intercity bus lines 2,850
  - urban/suburban bus/tram lines (Zagreb, Split, Osijek and Rijeka) 283
  - rail 1,759
  - boat/ ferry 49
- line routes 5,167
- vehicle journeys 20,827
URBAN PUBLIC TRANSPORT (EXAMPLE ZAGREB)
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PASSENGER MODEL – SEASON AND PEAK HOUR MODELS

4 separate models - approach

- Off season - 24 hour (Demand model (basic model))
- Off season - peak (Factor model)
- Season - 24 hour (Demand model (special tourist purpose))
- Season - peak (Factor model)

Survey %
Count data %

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FREIGHT MODEL – SEASON AND PEAK HOUR MODELS

4 separate models - approach

Off season

Full demand model (calibrated+validated)

Off season – 24 hour

24 hour

1.2

Season

Season – 24 hour

Off season – peak

6.7%

Factor model

Peak hour

Season – peak

Factor model

6.8%

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PASSENGER MODEL VALIDATION

Hierarchical Validation Process (Top down)

Level 3

• Base year assignment (offseason weekday)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>0.94</td>
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<tr>
<td>Share of links with GEH &lt;5</td>
<td>67%</td>
</tr>
<tr>
<td>Share of links with GEH &lt;10</td>
<td>88%</td>
</tr>
<tr>
<td>Transport work difference</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>
Hierarchical Validation Process (Top down)

Level 3

- 480 Road Count Locations for Validation
Hierarchical Validation Process (Top down)

- 480 Road Count Locations for Validation

\[ R^2 = 0.92 \]

GEH<5: 95% of all links

**FREIGHT MODEL VALIDATION**
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FORECAST OF SOCIO-ECONOMIC DEVELOPMENT

Agreement between MMATI, Consultants and Stakeholders to use:

EU Energy, Transport and GHG Emissions: TRENDS TO 2050
FORECAST DRIVERS (PASSENGER – TRENDS TO 2050)

Croatia

Croatia (yearly growth %)

Average household size (persons)  |  Gross Domestic Product  |  Household Expenditure  |  Population

2010-2020  |  2020-2030  |  2030-2040

-1.0  |  -0.5  |  -  |  0.5  |  1.0  |  1.5  |  2.0  |  2.5

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FORECAST DRIVERS (RESULTS FROM HH SURVEY)

Mobility = Number of trips = f (household income, motorisation rate)

![Graph showing the relationship between mobility and household income](image)

- Total trips (without transfers)
  - < 500 HRK: 2.67
  - 501-1000 HRK: 2.84
  - 1001-1500 HRK: 2.97
  - 1501-2000 HRK: 2.94
  - 2001-3000 HRK: 3.10
  - 3001-4000 HRK: 3.21
  - 4001-5000 HRK: 3.19
  - > 5001 HRK: 3.13

![Bar chart showing total trips for different vehicle ownership](image)

- Total trips (without transfers)
  - No car: 2.76
  - One car: 3.08
  - Two or more cars: 3.2
FORECAST DRIVERS (FREIGHT – TRENDS TO 2050)

Socioeconomic Indicators 2010-2030

EU Energy, Transport and GHG Emissions Trends to 2050
Factors used for Import / Export / Transit flows
# LIST OF ON-GOING PROJECTS OF NATIONAL IMPORTANCE DO-MINIMUM SCENARIO

<table>
<thead>
<tr>
<th>Project</th>
<th>MOTORWAY AND ROAD EXTENSIONS (HRVATSKIE AUTOCESTE d.o.o.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>PROJECT STATUS</td>
</tr>
<tr>
<td></td>
<td>Under construction</td>
</tr>
<tr>
<td>Motorway / Autocesta A3 Bregana – Zagreb – Lipovac</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja čvora Lipovljani</td>
<td></td>
</tr>
<tr>
<td>Motorway / Autocesta A4 Zagreb – Goričan</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja čvora Sveta Helena</td>
<td></td>
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<tr>
<td>• Izgradnja čvora Goričan</td>
<td></td>
</tr>
<tr>
<td>Motorway / Autocesta A5 Beli Manastir – Osijek – Border / Granica BiH</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice granica R. Mađarske – Beli Manastir, l. faza (5 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice Beli Manastir – most Drava, l. faza (18,3 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja mosta Drava (2,5 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice most Drava – Osijek (3,8 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja mosta Sava (troškova snosi 50% RH, 50% BiH)</td>
<td></td>
</tr>
<tr>
<td>Motorway / Autocesta A8 Istarski Ipsilon</td>
<td></td>
</tr>
<tr>
<td>• Rekonstrukcija (prelaganje) i zaštita postojećih elektroenergetskih vodova na Istarskom ipsilonu (faza 2B1 Rogovići-Vranja)</td>
<td></td>
</tr>
<tr>
<td>• Prelaganje i zaštita postojeće vodovodne mreže na Istarskom ipsilonu (faza 2B1 Rogovići-Vranja)</td>
<td></td>
</tr>
<tr>
<td>Motorway / Autocesta A11 Zagreb – Sisak</td>
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</tr>
<tr>
<td>Izgradnja nadvođnjaka &quot;Ranžirni&quot;</td>
<td></td>
</tr>
<tr>
<td>State Road / Državna cesta DC 10 Sveta Helena – GP Gola</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice Gradec – Križevci (12,5 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice Križevci – Kloštar Vojakovački (7,5 km)</td>
<td></td>
</tr>
<tr>
<td>State Road / Državna cesta DC 12 Sveta Helena – GP Gola</td>
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</tr>
<tr>
<td>• Izgradnja dionice Vrbovec 2 – Farkaševac (10,6 km)</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja dionice Farkaševac – Bjelovar (16,4 km)</td>
<td></td>
</tr>
<tr>
<td>Connecting Road / Spojna cesta CP Karamatići – luka Ploče</td>
<td></td>
</tr>
<tr>
<td>• Izgradnja ulaza u luku Ploče</td>
<td></td>
</tr>
</tbody>
</table>
# LIST OF ON-GOING PROJECTS OF NATIONAL IMPORTANCE DO-MINIMUM SCENARIO

<table>
<thead>
<tr>
<th>Project</th>
<th>PROJECT STATUS</th>
<th>Under construction</th>
<th>Tendering process</th>
<th>OP 2013-2016, but not started</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROAD EXTENSIONS (HRVATSKE CESTE d.o.o.)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>• Izgradnja cestovnog podvožnjaka na željezničko – cestovnom prijelazu u Osječkoj ulici u Slavonskom Brodu (križanje željezničke pruge i D423)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>• Obilaznica Trpnja (rekonstrukcija D415 s prolazom kroz naselje Trpanj, II. faza, L = 1,54 km)</td>
<td></td>
<td></td>
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<tr>
<td>• Brza cesta Popovec – Marija Bistrica – Zabok sa spojem na Breznički Hum;</td>
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</tr>
<tr>
<td>• Zabok-Krapina (faza I. Zabok-Sv. Krž Začretje); L=6,4 km</td>
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<td>• Izgradnja mosta kopno – otok Ćiovo s pristupnim cestama i instalacijama (duljina mosta iznosiće 552,1 metara), I faza</td>
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<td>• Solin – Plano LOT 2, Kaštela</td>
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<td>• Izgradnja brze Podravske ceste, dionica: Virovitica – Suhopolje (L=9.1 km)</td>
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<td>• Obilaznica Zaprešića (Zaprešić-Prigorje Brdovečko, I. poddionica)</td>
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<td>• Denivelacija križanja D310 i željezničke pruge u Jastrebarskom</td>
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<td>• Prolaz kroz grad Pag (L=908 m)</td>
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<td>• Most kopno-otok Ćiovo II faza/ spojne ceste D315-D8 i D126-Ž6134</td>
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<td>• Brza cesta Popovec – Marija Bistrica – Zabok sa spojem na Breznički Hum/ dionica, Zlatar Bistrica – Andraševac, faza III i dionica: Zlatar Bistrica – Andraševac, faza VI, duljine cca 6,5 km</td>
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<td>• Izmještanje državne ceste D225 dionica: Zaprešić-Prigorje Brdovečko l. poddionica: od km 0+000 km 1+959,88 II. FAZA od km 0+687,00 do km 1+959,88</td>
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<td>• Izgradnja zaobilaznice grada Vodica s instalacijama</td>
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<td>• Spojna cesta Zabok-Krapina, faza 2.1. II. - u pripremi za početak javne nabave do kraja ove godine</td>
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<tr>
<td>• Priklučna prometnica istočne obilaznice Velike Gorice i zračne luke Zagreb- proveden postupak javne nabave, odabran Viadukt za izvođača radova</td>
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<td>• Obilaznica Vinkovaca</td>
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<tr>
<td>RAIL INFRASTRUCTURE (HŽ INFRASTRUKTURA d.o.o.)</td>
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<td>• Rekonstrukcija postojećeg i izgradnja drugog kolosijeka dionice pruge Dugo Selo - Križevci</td>
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</table>
THE TASKS AND THE APPROACH: DEVELOPING A NATIONAL TRANSPORT MODEL FOR CROATIA

I. Collection of Data
II. Analysis of existing transport system
III. Development of Freight Demand Model
IV. Development of Passenger Demand Model
V. Development of Network Model
VI. Assignment: Calibration and Validation of the Model
VII. Development of Forecast Model 2020, 2030 and 2040 (Do Minimum)

VIII. Development of Forecast Scenario for Strategy (Do Something)
MODELLING THE NATIONAL TRANSPORT STRATEGY
(.DO SOMETHING SCENARIO)

- National Strategy Team provided document with description, effects (capacity, speed, interoperability)
- 10 measures could directly be modelled in the National Transport Model

<table>
<thead>
<tr>
<th></th>
<th>New alignment</th>
<th>Improved service*</th>
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</thead>
<tbody>
<tr>
<td><strong>rail</strong></td>
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<tr>
<td>Zagreb-Karlovac</td>
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<td>Karlovac-Rijeka</td>
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<td>Zagreb-Križevci</td>
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<td>Križevci-HU</td>
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<td>x</td>
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<tr>
<td>Zagreb-Novska</td>
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<td>x</td>
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<tr>
<td>Novska-RS</td>
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<tr>
<td><strong>road</strong></td>
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<td>Bridge Gradiška</td>
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<td>A5 Osijek-HU</td>
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<td>Pelješac Bridge</td>
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<tr>
<td>A11 Lekenik-Sisak</td>
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<td>x</td>
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</table>

*80 km average travel speed (design speed 100 km/h)
AGENDA

1. Introduction
2. The Tasks and Approach
3. The Results
4. The Way Forward
THE RESULTS

I. Base Year Model Results (2013)
II. Model Results for Do-minimum 2020, 2030, 2040
III. Model Results for Strategy 2020, 2030, 2040
IV. Interpretation and evaluation of Results
THE RESULTS

I. Base Year Model Results (2013)
II. Model Results for Do-minimum 2020, 2030, 2040
III. Model Results for Strategy 2020, 2030, 2040
IV. Interpretation and evaluation of Results
BASE YEAR MODEL RESULTS - ASSIGNMENT FLOW

Annual Average (Off-Season)
BASE YEAR MODEL RESULTS - ASSIGNMENT FLOW
BASE YEAR MODEL RESULTS – VOLUME / CAPACITY RATIO

Annual Average (Off-Season)
BASE YEAR MODEL RESULTS – VOLUME / CAPACITY RATIO

Season
BASE YEAR MODEL RESULTS - PUBLIC TRANSPORT-ADT

Total Public transport assignment
BASE YEAR MODEL RESULTS - PUBLIC TRANSPORT-ADT
BASE YEAR MODEL RESULTS - PUBLIC TRANSPORT-ADT

Rail assignment

NTMC Base Year Analysis
Link Attributes
Passenger kilometers (AP)
0.000km 2495.988km 4991.976km 9983.953km
Type number:
Ferry / Boat
Rail

Dr Uwe Reiter  I Closing Ceremony I 04 May 2016 I Page 71
BASE YEAR MODEL RESULTS – PRIVATE TRANSPORT ACCESSIBILITY

Private Transport: Cars
BASE YEAR MODEL RESULTS – PUBLIC TRANSPORT ACCESSIBILITY

Public Transport: Rail & Buses
THE RESULTS

I. Base Year Model Results (2013)

II. Model Results for Do-minimum 2020, 2030, 2040

III. Model Results for Strategy 2020, 2030, 2040

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MODEL RESULTS FOR DO MINIMUM SCENARIO

VOLUME/CAPACITY

Base year

Annual Average

NTMC BASE YEAR ANALYSIS
ADT

Road traffic volumes (veh/day) & Volume/Capacity ratio

NUTS-2_HR

<table>
<thead>
<tr>
<th>Volume PrT [veh] (AP)</th>
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<td>0 16250 32500 65000</td>
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</table>

V/C ratio

- Green: <= 0.25
- Yellow: <= 0.50
- Orange: <= 0.75
- Red: > 0.75

0 40 80 120 km
MODEL RESULTS FOR DO MINIMUM SCENARIO

VOLUME/CAPACITY

Year 2020
Annual Average

NTMC DO MINIMUM SCENARIO
YEAR 2020 - ADT

Road traffic volumes (veh/day) & Volume/Capacity ratio

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<th>NUTS-2_HR</th>
<th>Volume PrT [veh] (AP)</th>
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VI_RATIO

- Green: <= 0.25
- Yellow: <= 0.50
- Orange: <= 0.75
- Red: > 0.75
MODEL RESULTS FOR DO MINIMUM SCENARIO

VOLUME/CAPACITY

Year 2030
Annual Average

NTMC  DO-MINIMUM SCENARIO
YEAR 2030 - ADT

Road traffic volumes (veh/day) & Volume/Capacity ratio

- Adriatic
- Continental

V/C Ratio:
- <= 0.25
- <= 0.50
- <= 0.75
- > 0.75

Volume PrT [veh] (AP)
- 0 16250 32500 65000
MODEL RESULTS FOR DO MINIMUM SCENARIO
VOLUME/CAPACITY

Year 2040
Annual Average

NTMC DO-MINIMUM SCENARIO
YEAR 2040 - ADT
Road traffic volumes (veh/day) & Volume/Capacity ratio

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<th>Volume Pr/T [veh] (AP)</th>
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0 16250 32500 65000

VICRATIO

- <= 0.25
- <= 0.50
- <= 0.75
- > 0.75

0 40 80 120 km
THE RESULTS

I. Base Year Model Results (2013)
II. Model Results for Do-minimum 2020, 2030, 2040
III. Model Results for Strategy 2020, 2030, 2040
IV. Interpretation and evaluation of Results
MODEL RESULTS FOR STRATEGY SCENARIO
DO-SOMETHING FORECAST 2030
THE RESULTS

I. Base Year Model Results (2013)

II. Model Results for Do-minimum 2020, 2030, 2040

III. Model Results for Strategy 2020, 2030, 2040

IV. Interpretation and evaluation of Results
INTERPRETATION AND EVALUATION OF RESULTS

The National Transport Model **represents current transport conditions**
- It is calibrated and validated towards large dataset of empirical data

The National Transport Model allows to **forecast future transport conditions**
- The results show effect of socio-economic development
  - Population
  - Economy

The National Transport Model **calculates impacts** of strategies and measures

The National Transport Model is **sensitive** to changed conditions
- Better railway services result in more demand attracted to rail
- Additional road infrastructure attracts transport from other roads
- An extended set of measures will result in more **impacts and effects**
AGENDA

1. Introduction
2. The Tasks and Approach
3. The Results
4. The Way Forward
WHAT TO DO WITH THE MODEL?

Basis for future **National** Transport Planning in Croatia

- Identification of current and future bottlenecks and shortcomings
- Definition of National Strategy, of measures and projects
- Calculation of impacts on
  - Transport system itself
  - Natural environment
  - Social environment
  - Man-made environment
- Selection of best Strategy and most effective measures

Basis for future **Regional** Transport Planning in Croatia

- Extraction of sub-network models for regions / counties
- Development of more detailed regional models
- Use of regional models for regional transport planning
## MAINTENANCE INTERVAL

### Activity

<table>
<thead>
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<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
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### Notes

- According to client’s needs
- X indicates the year the activity was performed.
THANK YOU FOR YOUR ATTENTION

Investing in Future
European Union

The project is co-financed by European Union from the European Regional Development Fund

Dr Uwe Reiter
Zagreb, 04 May 2016