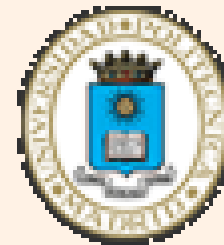


# Roundabout practice and research in Spain

Manuel G. Romana

Technical University of Madrid

*6th Int Symp Highway Capacity (ISHC 2011) Stockholm June 2011*



POLITÉCNICA



# Overview

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- Relatively recent solution
- Embraced with a passion (all sizes, many uses)
- Top-down country
- Two different outlooks
  - Design: More emphasis in capacity than LOS for intersections
  - Evaluation: whatever it takes
    - (SIDRA / VISSIM / other)



# Guidelines and recommendations

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- Detailed geometric guidelines
  - Ministry and some regional entities
- Focus on capacity
- Based on scarce research
  - More of a testing phase



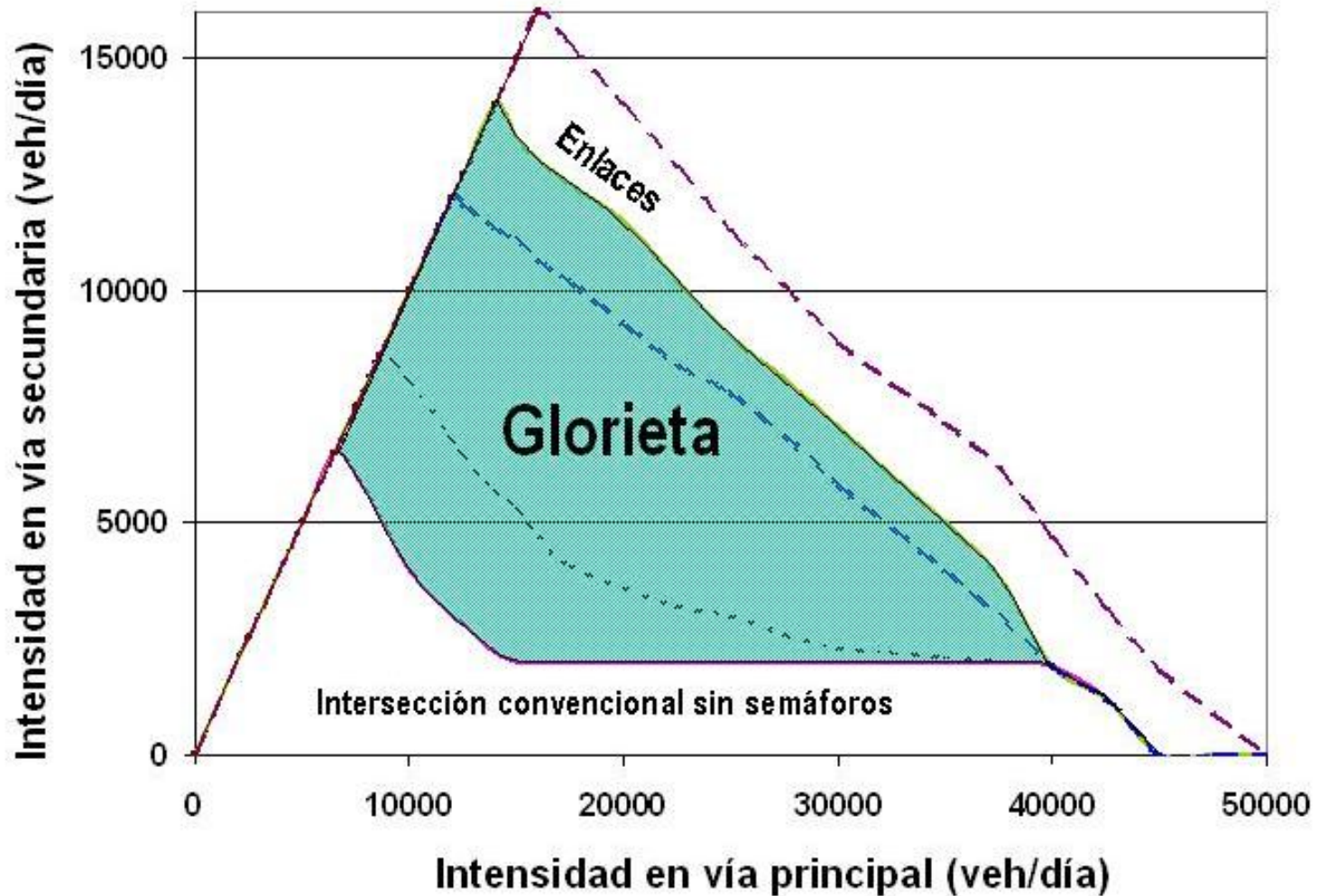
# Guidelines and recommendations

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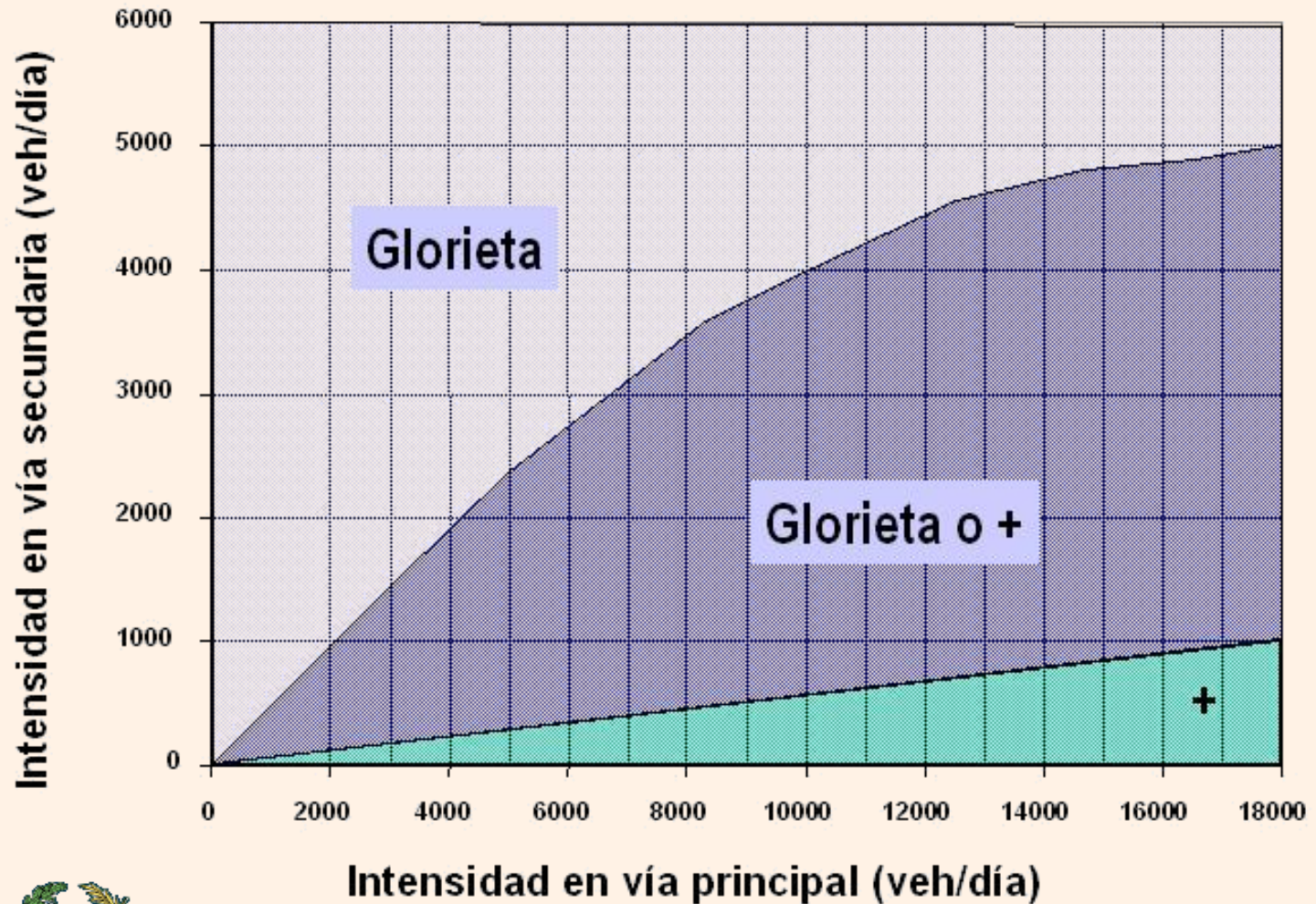
- Plan view: Valencia, 2006
- Norma 3.1-IC. Trazado, Ministry, 2000
- Recomendaciones diseño de glorietas en carreteras suburbanas. Madrid Region, 1995
- Recomendaciones planeamiento y proyecto carreteras urbanas, Ministry, 1992
- Recomendaciones sobre glorietas. Ministry, 1989.



# Guideline for use



# Guideline for use



# Access capacity and waiting times

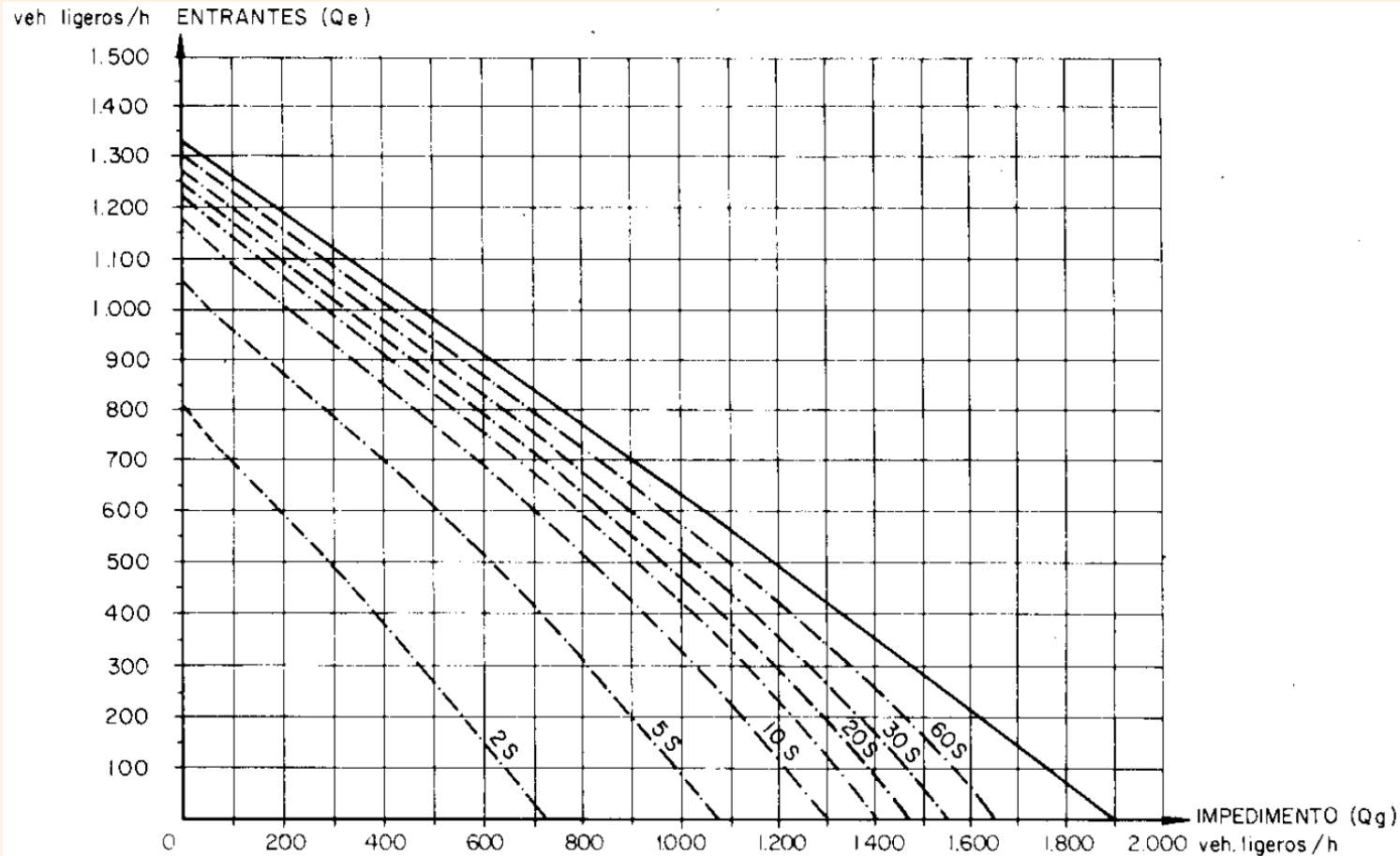


FIG. 3

CAPACIDAD DE LA ENTRADA (3,5 m. de anchura) DE UNA GLORIETA E ISOCRONAS DEL TIEMPO DE ESPERA



# In practice

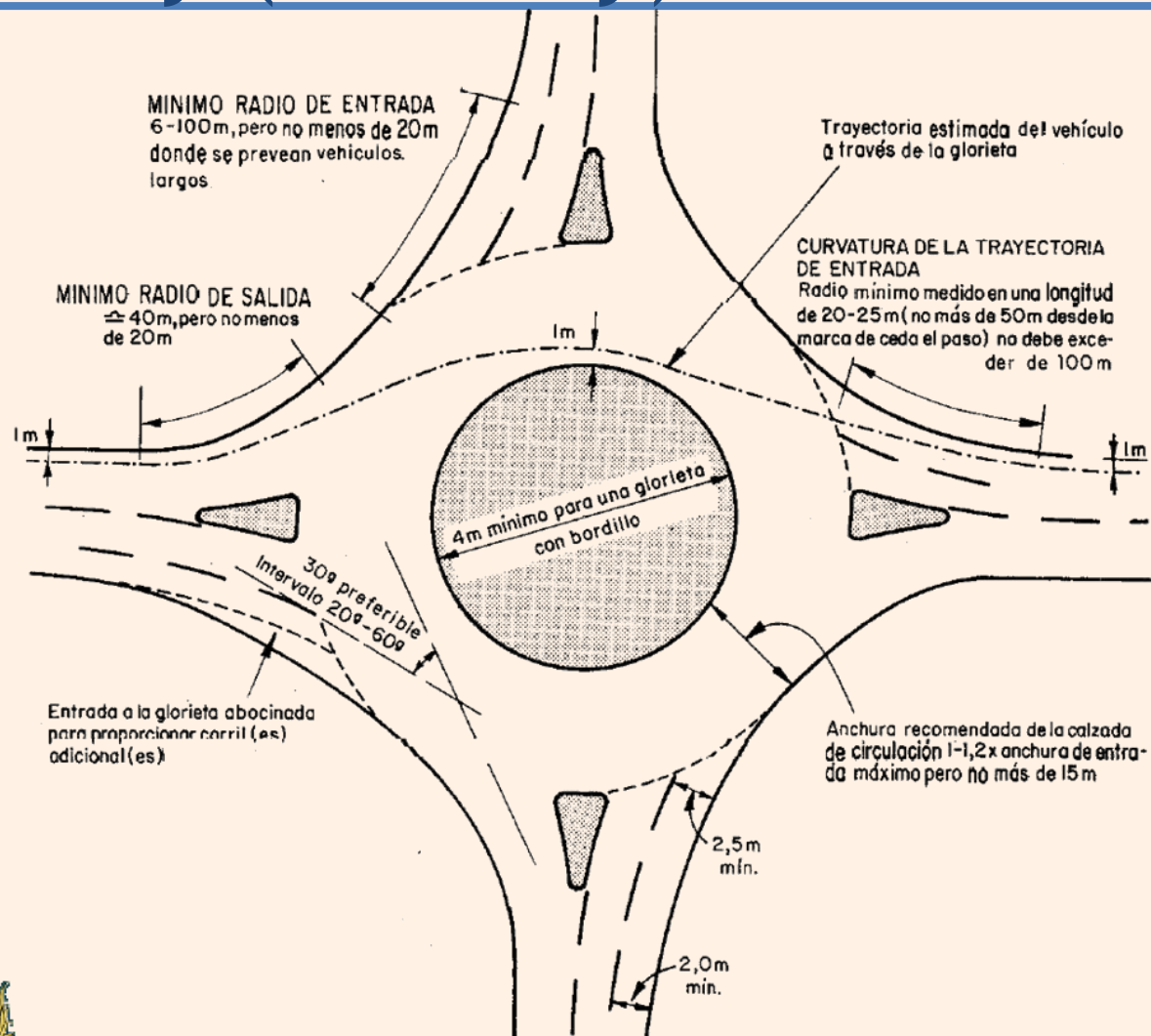
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- Up to 40000
- More than 30000
- Depending on
  - movements
  - how far apart





# Geometry (Ministry)



# Accesses

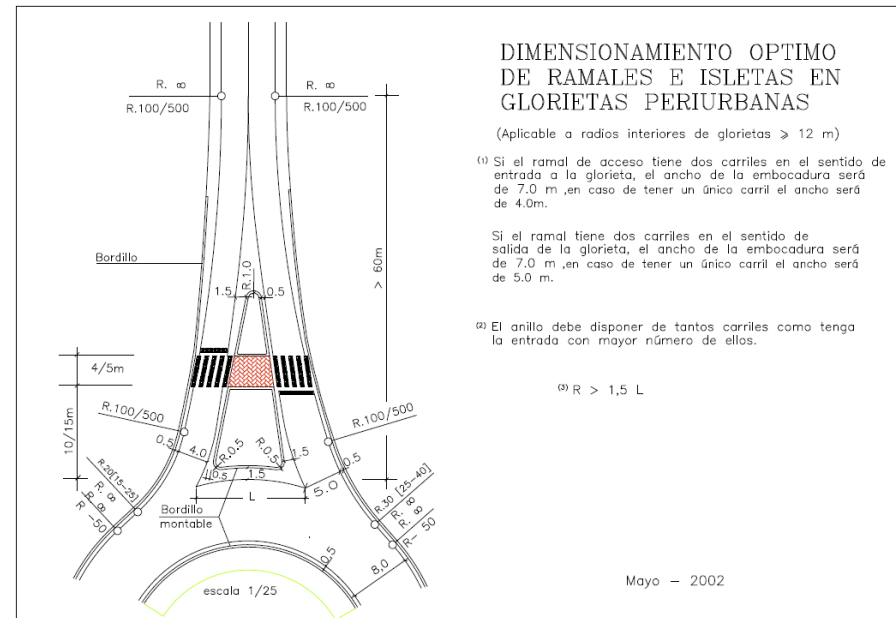
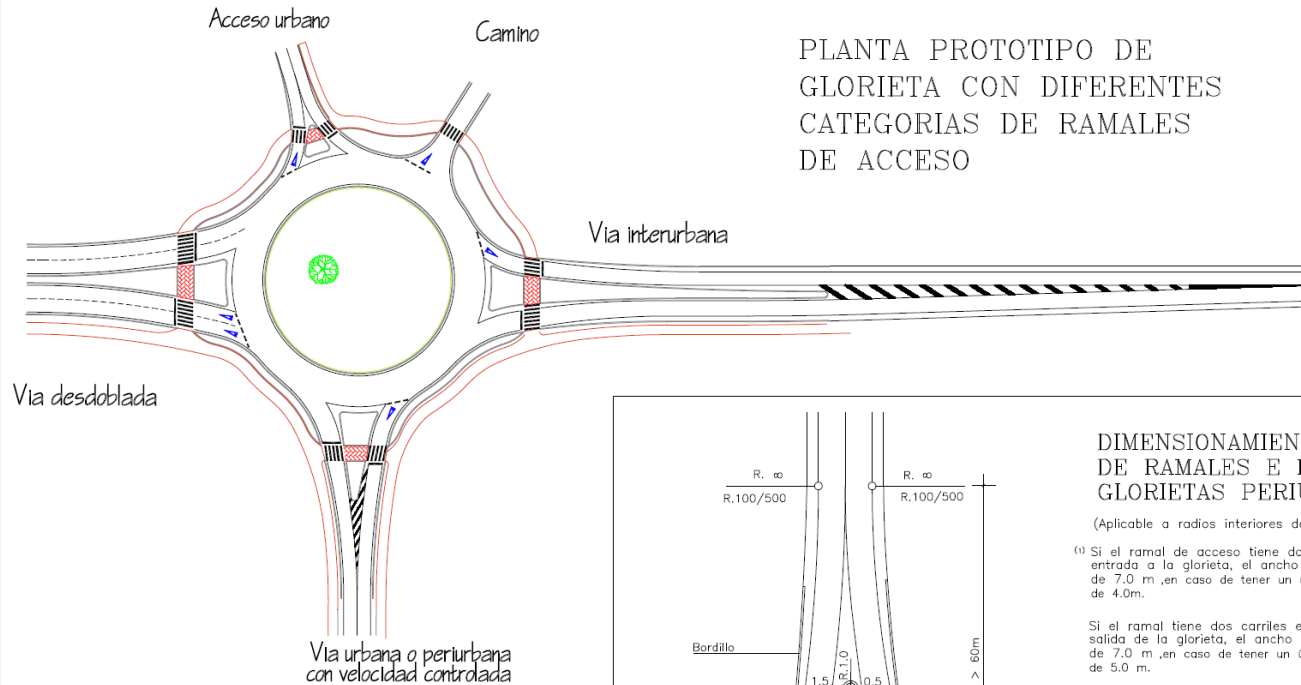
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# Valencia



# Valencia

Urban access

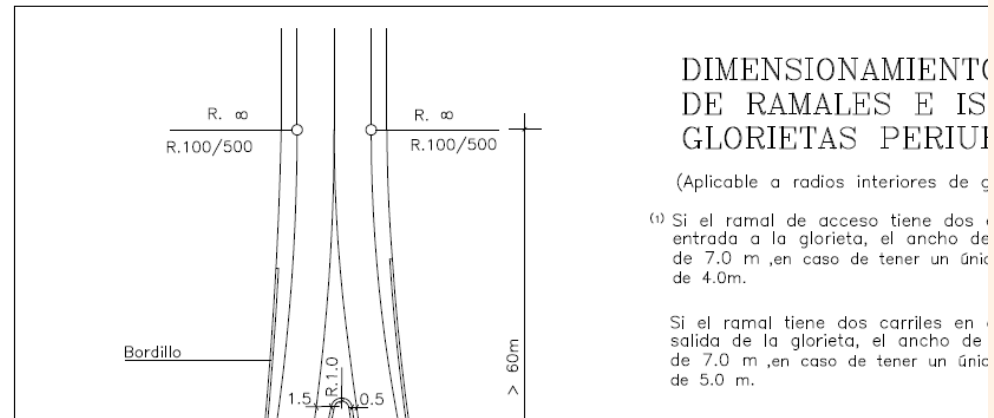
Rural (not a road)

PLANTA PROTOTIPO DE  
GLORIETA CON DIFERENTES  
CATEGORIAS DE RAMALES  
DE ACCESO

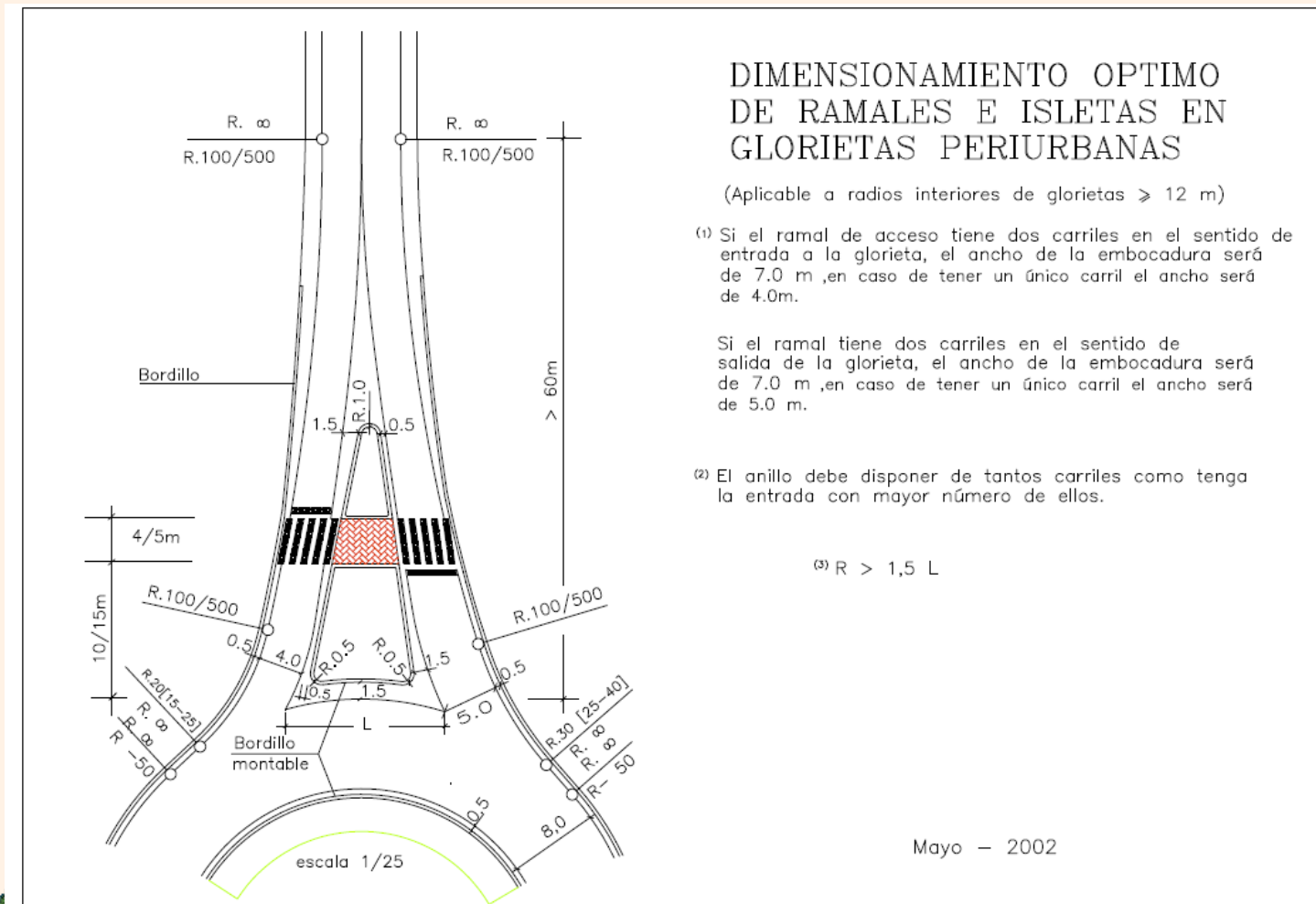
Rural highway – 2 lane highway

Multilane

Urban or suburban  
reduced speed



# Valencia

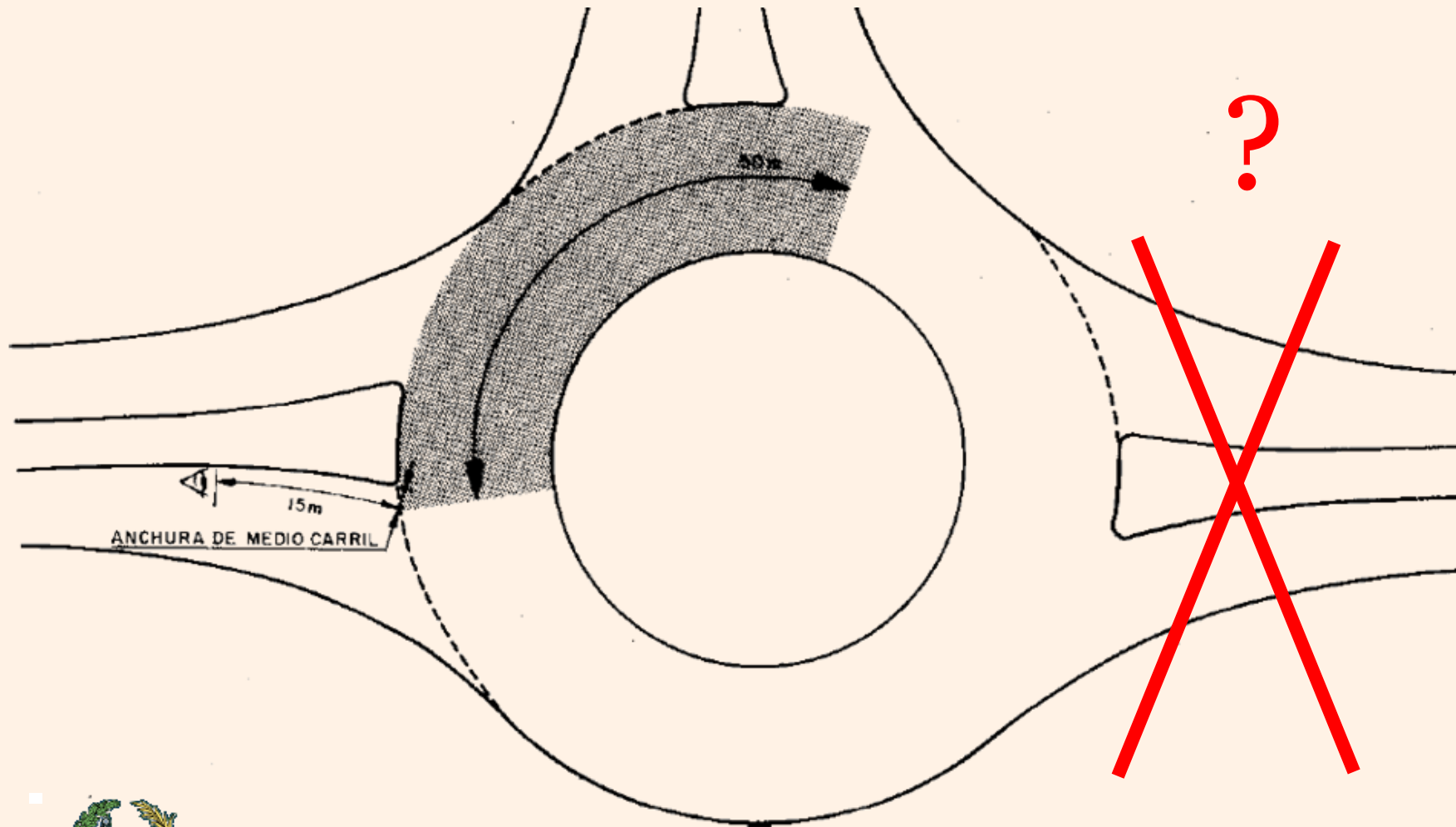


# Madrid, small circles

- ADT < 5000
- Not enough space available



# Visibility



# Visibility





# Visibility

---



# Visibility



*out the Sign Highway Capacity (ISHC 2011) Stockholm June 2011*

# Visibility



# Entry



# Entry



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# Entry



# Entry



# Entry





# Entry



© 2014 Google Informar de una incidencia



# Entry



# Architecture

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[http://www.lasextanoticias.com/videos/ver/aberracion\\_a\\_pie\\_de\\_rotonda/325161](http://www.lasextanoticias.com/videos/ver/aberracion_a_pie_de_rotonda/325161)



# Recent research

---

- Test capacity
- Safety
- Alternatives to roundabouts (Madrid)
- Validate capacity model and critical and follow-up intervals



# Capacity

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- Over most european values
  - British
  - CETUR
- Not much worry for LOS unless it is almost daily
- Direct right turnos (if possible and solution)
- Local fixes



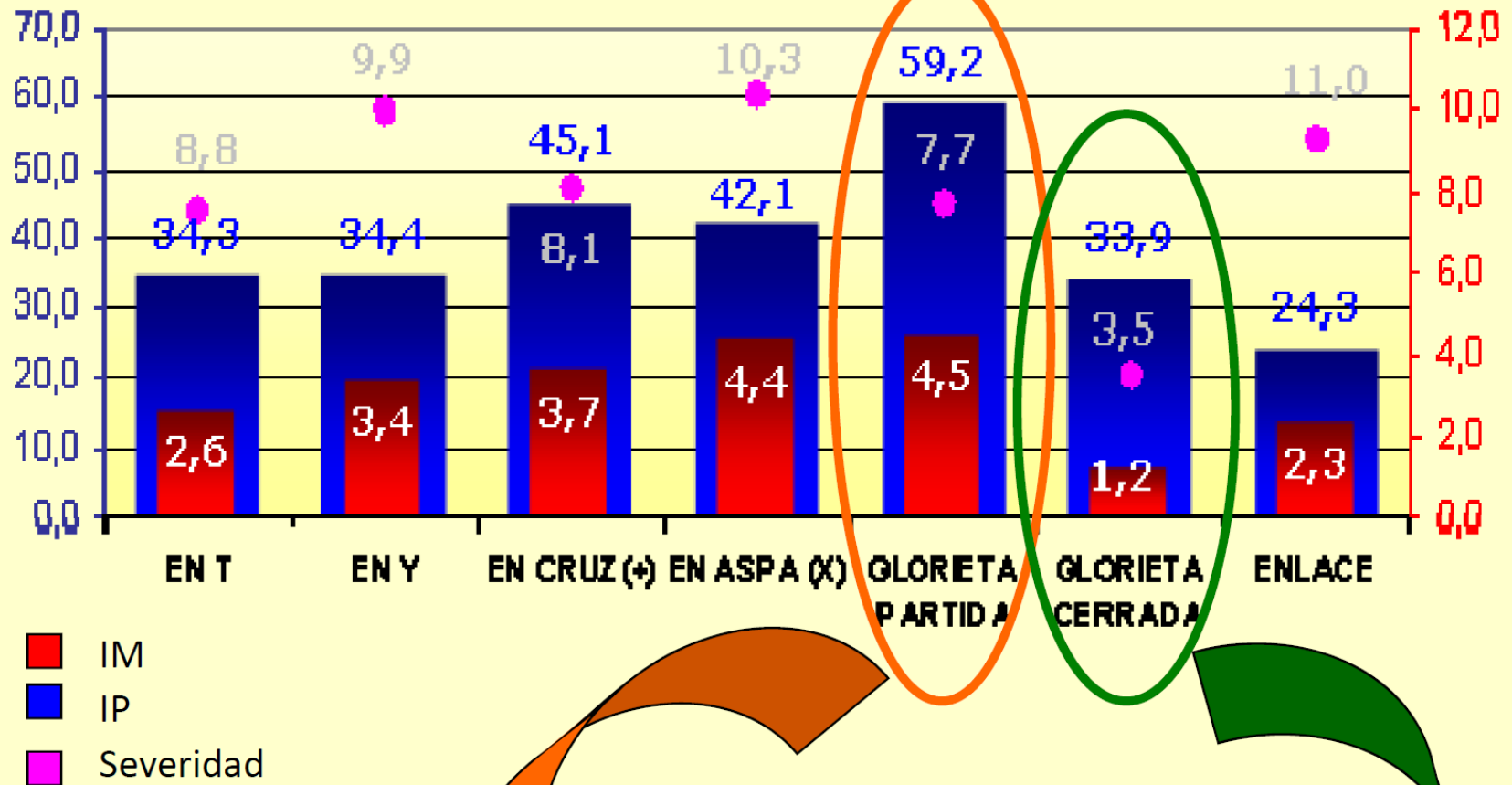
# Capacity

---

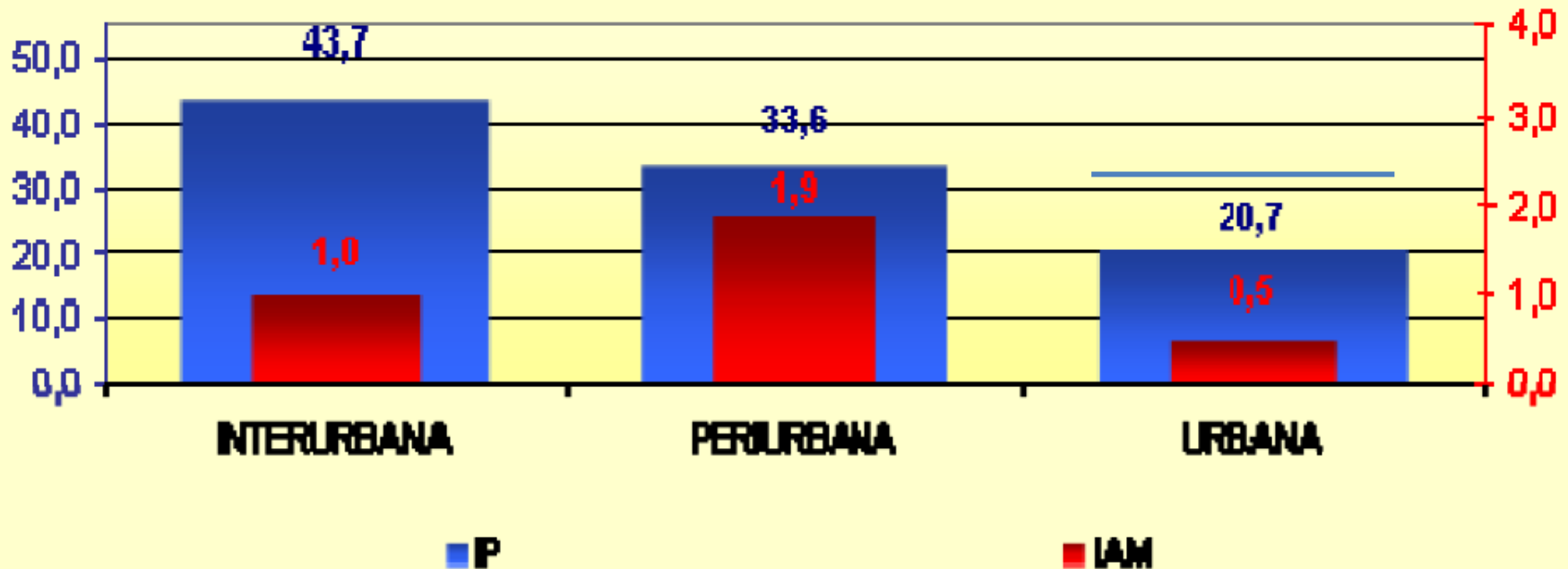
- Critical interval: 3.3 to 3.5 s
- Follow-up: about half



# Safety (2011)



# Safety (2011)



$$IP(3 \text{ yr}) = \frac{(\text{N}^\circ \text{ of accidents w/ injury}) \times 10^8}{\text{ADT} \times 365 \times \text{Length (km)} \times 3}$$

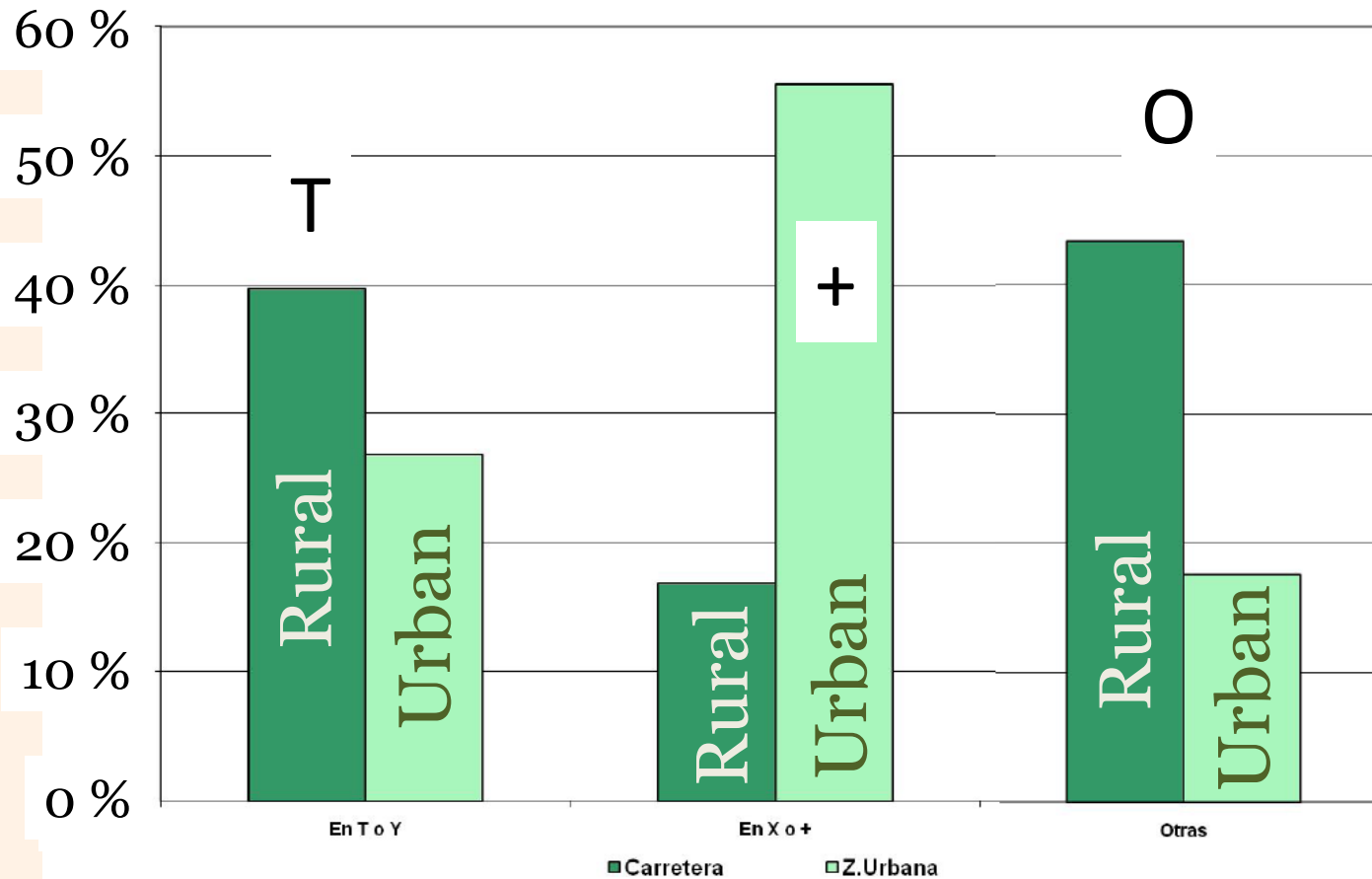
$$IAM(3 \text{ yr}) = \frac{(\text{N}^\circ \text{ of accidents w/ injury}) \times 10^8}{\text{ADT} \times 365 \times \text{Length (km)} \times 3}$$





# Safety (2011)

Accidentes con víctimas según características de la vía  
EN INTERSECCIÓN



# Safety

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- Roundabouts work better than traffic signals in urban areas
- Rural areas: roundabouts are not so good in number of accidents (open roundabouts are better)
  - But low mortality
  - And open roundabouts work well when not great volume crosses
- Urban areas: open roundabouts work much better when w/traffic signals



# Turbo roundabouts

---

- First ones (three) built in Grado (Asturias)
  - [http://www.youtube.com/watch?v=vGSWjPIGQ4Y&feature=player\\_embedded#at=24](http://www.youtube.com/watch?v=vGSWjPIGQ4Y&feature=player_embedded#at=24)
- Doubts as its results under heavy flows
  - Limited discipline of drivers



# Ongoing



# Ongoing



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# Ongoing

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- Revise values of critical and follow-up intervals
  - Previous measures when there were a shorter experience by drivers
- Obtain values of capacity and compare w/ HCM and simulation
- What to do here?

